Government of Western Australia
School Curriculum and Standards Authority

2016 ATAR Course Examinations
Multiple-choice answer sheet

Page no. 999999

Course: Chemistry YR 11

Surname:

Other names: PPT REACTIONS

Course code: C H E

Centre code

SCSA student number

Instructions

Candidate please sign here.

Signature: _____

For each question, shade the box to indicate your answer. Use **only** a blue or black pen to shade the boxes.

For example, if b is your answer: a ☐ b ■ c ☐ d ☐

If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape.

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If you then want to use your first answer b, cross out d and then circle b.

a ☐ b ⊗ c ☐ d ☒

Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Supervisor use only

Absent ☐

Shade the box if the candidate was absent from the examination.

Supervisor's initials ☐

1	a ☐ b ☐ c ☐ d ☐
2	a ☐ b ☐ c ☐ d ☐
3	a ☐ b ☐ c ☐ d ☐
4	a ☐ b ☐ c ☐ d ☐
5	a ☐ b ☐ c ☐ d ☐

6	a ☐ b ☐ c ☐ d ☐
7	a ☐ b ☐ c ☐ d ☐
8	a ☐ b ☐ c ☐ d ☐
9	a ☐ b ☐ c ☐ d ☐
10	a ☐ b ☐ c ☐ d ☐

This sheet will be collected separately by the supervisor at the end of the examination.

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Section 1 – Multiple Choice (10 marks)

1. Which of the following combinations of solutions will **not** produce a precipitate on mixing? (1 mark)
   a. Sodium nitrate, barium chloride, ammonium carbonate, potassium hydroxide
   b. Potassium nitrate, barium chloride, ammonium nitrate, magnesium chloride
   c. Barium chloride, calcium nitrate, potassium sulfate, mercury(II) nitrate
   d. Ammonium chloride, barium nitrate, sodium sulfate, calcium iodide

2. When a few drops of gold(III) chloride ($AuCl_3$) solution are added to a few drops of sodium hydroxide (NaOH) solution, a precipitate is formed. On the basis of this information, the net ionic equation for the formation of the precipitate is which one of the following? (1 mark)
   a. $AuCl_3\ (aq) + NaOH\ (aq) \rightarrow Au(OH)_3\ (s) + NaCl\ (aq)$
   b. $Na^+\ (aq) + Cl^-\ (aq) \rightarrow NaCl\ (s)$
   c. $AuCl_3\ (aq) + 3\ NaOH(aq) \rightarrow Au(OH)_3\ (s) + 3\ NaCl\ (aq)$
   d. $Au^{3+}\ (aq) + 3\ OH^-\ (aq) \rightarrow Au(OH)_3\ (s)$

3. 5 g of three different solids are dissolved in water. After continued stirring, it is noted that there is a white insoluble solid in the beaker. Which one of the following lists contains chemicals that will produce this observation? (1 mark)
   a. ammonium phosphate, potassium carbonate and sodium bromide
   b. sodium chloride, copper(II) sulfate and potassium nitrate
   c. barium nitrate, sodium sulfate and potassium chloride
   d. barium nitrate, calcium chloride and potassium iodide

4. Which one of the following sets of 0.5 gL^{-1} solutions can be mixed to make a blue solution without a precipitate? (1 mark)
    a. sodium iodide, copper(II) chloride, silver nitrate
    b. magnesium sulfate, potassium nitrate, copper(II) ethanoate
    c. copper(II) chloride, ammonium carbonate, nickel(II) chloride
    d. potassium sulfate, ammonium carbonate, sodium phosphate

5. In which one of the following will there be no visible reaction?
    a. Hydrochloric acid is added to a sodium carbonate solution
    b. Solutions of ammonium phosphate and potassium sulphide are mixed together.
    c. Solutions of silver nitrate and potassium chloride are mixed together
    d. Three solutions are mixed containing: potassium nitrate, barium hydroxide and calcium ethanoate.

6. Which of the following reagents could be used to distinguish between unknown solutions of silver nitrate and lead(II) nitrate? (1 mark)

I water

II sodium ethanoate

III potassium iodide

IV ammonium sulfide

    a. I and II
    b. II and III
    c. III and IV
    d. None of the above

7. Which set of two ionic compounds will react to form a solid? (1 mark)
    a. Manganese nitrate and potassium chloride
    b. Ammonium carbonate and sodium sulphide
    c. Barium hydroxide and silver ethanoate
    d. Strontium nitrate and lithium sulphate

8. Aluminium nitrate and sodium phosphate react to form a precipitate. Which of the following equations describes this reaction using a net ionic equation? (1 mark)
    a. $Al(NO_3)_3\ (aq) + Na_3PO_4\ (aq) \longrightarrow AlPO_4\ (s) + 3\ NaNO_3\ (aq)$
    b. $Al^{3+}\ (aq) + NO_3^-\ (aq) + Na^+\ (aq) + PO_4^{3-}\ (aq) \longrightarrow AlPO_4\ (s) + Na^+\ (aq) + NO_3^-\ (aq)$
    c. $Al^{3+}\ (aq) + PO_4^{3-}\ (aq) \longrightarrow AlPO_4\ (s)$
    d. $Na^+\ (aq) + NO_3^-\ (aq) \longrightarrow NaNO_3\ (s)$

9. Which of these pairs of ionic compounds would produce a black solid from a blue solution? (1 mark)
    a. $Cu(NO_3)_2$ and K_2S
    b. $Ag(CH_3COO)$ and Na_2S
    c. $Cu(NO_3)_2$ and NH_4Cl
    d. Zn and HCl

10. Two solutions are mixed together. The observation taken was that a pale yellow solid formed from a blue solution. Which of the following solutions would produce this observation? (1 mark)
    a. Copper(II) nitrate and lead ethanoate
    b. Nickel(II) chloride and silver nitrate
    c. Copper(II) iodide and silver nitrate
    d. Nickel(II) sulfate and lead nitrate

End of Section 1

Section 2 – Short Answer (17 marks)

Question 12 (5 marks)

Kidney stones are a precipitate (solid) formed when calcium (Ca^{2+}) and oxalate ($C_2O_4^{2-}$) ions build up and combine in a person's kidneys. As calcium oxalate is insoluble in water, the kidney stone must be excreted as a solid. A balanced molecular equation is shown below:

$Na_2C_2O_4$ ( ) + $Ca(CH_3COO)_2$ ( ) → 2 $NaCH_3COO$ ( ) + CaC_2O_4 ( )

a. Write the **state symbols** for the equation above in the brackets provided. (1 mark)

b. Write the **net ionic equation** for the formation of calcium oxalate (2 marks)

c. Toothpaste containing fluoride ions is used to precipitate calcium fluoride on the teeth as a remineralisation method. Write the net ionic equation for the reaction of calcium and fluoride ions. (2 marks)

Question 13 (12 marks)

Write the **net ionic equation** for the reaction that occurs in each of the following procedures. If no reaction occurs write 'no reaction'.

Following this, describe in full what you would observe in each case, including any

- Colours
- Odours
- Precipitates (give the colour)
- Gases evolved

If no change is observed, you should state this.

a. Copper(II) nitrate solution is added to potassium carbonate solution (3 marks)

Equation:

Observation:

b. Zinc dust is added to a gold (III) chloride solution (3 marks)

Equation:

Observation:

c. Lead(II) nitrate solution is added to sodium sulfide solution (3 marks)

Equation:

Observation:

d. Cobalt(II) ethanoate is added to a solution of sodium phosphate. (3 marks)

Equation:

Observation:

End of Section 2

Section 3 – Extended Response (18 marks)

Question 14 (8 marks)

The following observations were taken from a school practical by two year 11 students, by mixing together solutions A-D. The solutions contain the ionic compounds sodium carbonate, barium iodide, potassium hydroxide and lead(II) nitrate.

	A	B	C	D
A		Yellow ppt	White ppt	White ppt
B	Yellow ppt		White ppt	NVR
C	White ppt	White ppt		NVR
D	White ppt	NVR	NVR	

a. Write a step-wise procedure to determine each of the unknown solutions. Clearly identify the four unknowns.

Question 15 **(10 marks)**

In a chemical laboratory, the labels have fallen off four identical reagent bottles. Each bottle contains a colourless solution. The labels read:

Silver nitrate	Potassium sulfide	Sodium hydroxide	Ammonium sulfate

Only three tests are required to distinguish between the four solutions.

Describe briefly the three chemical tests that can be used to identify which label belongs with each of the four reagent bottles. For each test describe clearly the expected observations and how they are used to identify the unknown solution.

Note: You may use any reagent in your tests but not acid-base indicators or a pH meter. No equations are required.

Test	Describe the test	Expected observations	Unknown substance formula
1			
2			
3			
4	The remaining unknown must be:		

End of Section 3

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Surname: ANSWERS

Other names:

Course code: C H E

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SCSA student number:

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    c. Barium chloride, calcium nitrate, potassium sulfate, mercury(II) nitrate
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2. When a few drops of gold(III) chloride ($AuCl_3$) solution are added to a few drops of sodium hydroxide (NaOH) solution, a precipitate is formed. On the basis of this information, the net ionic equation for the formation of the precipitate is which one of the following? (1 mark)
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    c. $AuCl_3\ (aq) + 3\ NaOH(aq) \rightarrow Au(OH)_3\ (s) + 3\ NaCl\ (aq)$
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3. 5 g of three different solids are dissolved in water. After continued stirring, it is noted that there is a white insoluble solid in the beaker. Which one of the following lists contains chemicals that will produce this observation? (1 mark)
    a. ammonium phosphate, potassium carbonate and sodium bromide
    b. sodium chloride, copper(II) sulfate and potassium nitrate
    c. barium nitrate, sodium sulfate and potassium chloride
    d. barium nitrate, calcium chloride and potassium iodide

4. Which one of the following sets of 0.5 gL^{-1} solutions can be mixed to make a blue solution without a precipitate? (1 mark)
    a. sodium iodide, copper(II) chloride, silver nitrate
    b. magnesium sulfate, potassium nitrate, copper(II) ethanoate
    c. copper(II) chloride, ammonium carbonate, nickel(II) chloride
    d. potassium sulfate, ammonium carbonate, sodium phosphate

5. In which one of the following will there be no visible reaction?
    a. Hydrochloric acid is added to a sodium carbonate solution
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    d. Three solutions are mixed containing: potassium nitrate, barium hydroxide and calcium ethanoate.

6. Which of the following reagents could be used to distinguish between unknown solutions of silver nitrate and lead(II) nitrate? (1 mark)

I water

II sodium ethanoate

III potassium iodide

IV ammonium sulfide

    a. I and II
    b. II and III
    c. III and IV
    d. None of the above

7. Which set of two ionic compounds will react to form a solid? (1 mark)
    a. Manganese nitrate and potassium chloride
    b. Ammonium carbonate and sodium sulphide
    c. Barium hydroxide and silver ethanoate
    d. Strontium nitrate and lithium sulphate

8. Aluminium nitrate and sodium phosphate react to form a precipitate. Which of the following equations describes this reaction using a net ionic equation? (1 mark)
    a. $Al(NO_3)_3\ (aq) + Na_3PO_4\ (aq) \longrightarrow AlPO_4\ (s) + 3\ NaNO_3\ (aq)$
    b. $Al^{3+}\ (aq) + NO_3^-\ (aq) + Na^+\ (aq) + PO_4^{3-}\ (aq) \longrightarrow AlPO_4\ (s) + Na^+\ (aq) + NO_3^-\ (aq)$
    c. $Al^{3+}\ (aq) + PO_4^{3-}\ (aq) \longrightarrow AlPO_4\ (s)$
    d. $Na^+\ (aq) + NO_3^-\ (aq) \longrightarrow NaNO_3\ (s)$

9. Which of these pairs of ionic compounds would produce a black solid from a blue solution? (1 mark)
    a. $Cu(NO_3)_2$ and K_2S
    b. $Ag(CH_3COO)$ and Na_2S
    c. $Cu(NO_3)_2$ and NH_4Cl
    d. Zn and HCl

10. Two solutions are mixed together. The observation taken was that a pale yellow solid formed from a blue solution. Which of the following solutions would produce this observation? (1 mark)
    a. Copper(II) nitrate and lead ethanoate
    b. Nickel(II) chloride and silver nitrate
    c. Copper(II) iodide and silver nitrate
    d. Nickel(II) sulfate and lead nitrate

End of Section 1

Section 2 – Short Answer (17 marks)

Question 12 (5 marks)

Kidney stones are a precipitate (solid) formed when calcium (Ca^{2+}) and oxalate ($C_2O_4^{2-}$) ions build up and combine in a person's kidneys. As calcium oxalate is insoluble in water, the kidney stone must be excreted as a solid. A balanced molecular equation is shown below:

$Na_2C_2O_4$ **(aq)** + $Ca(CH_3COO)_2$ **(aq)** → 2 $NaCH_3COO$ **(aq)** + CaC_2O_4 **(s)**

a. Write the **state symbols** for the equation above in the brackets provided. (1 mark)

b. Write the **net ionic equation** for the formation of calcium oxalate (2 marks)

Ca^{2+} (aq) + $C_2O_4^{2-}$ (aq) → CaC_2O_4 (s)

(1 mark correct, 1 mark balanced/states)

c. Toothpaste containing fluoride ions is used to precipitate calcium fluoride on the teeth as a remineralisation method. Write the net ionic equation for the reaction of calcium and fluoride ions. (2 marks)

Ca^{2+} (aq) + 2 F^- (aq) → CaF_2 (s) **(1 mark correct, 1 mark balanced states)**

Question 13 (12 marks)

Write the **net ionic equation** for the reaction that occurs in each of the following procedures. If no reaction occurs write 'no reaction'.

Following this, describe in full what you would observe in each case, including any

- Colours
- Odours
- Precipitates (give the colour)
- Gases evolved

If no change is observed, you should state this.

a. Copper(II) nitrate solution is added to potassium carbonate solution (3 marks)

Equation:

$Cu^{2+}(aq) + CO_3^{2-} \rightarrow CuCO_3(s)$

(1 mark correct, 1 mark balanced/states)

Observation:

A green solid is formed from a blue solution (1 mark)

b. Zinc dust is added to a gold (III) chloride solution (3 marks)

Equation:

$3\,Zn(s) + 2\,Au^{3+}(aq) \rightarrow 3\,Zn^{2+}(aq) + 2\,Au(s)$ **(2 marks)**

Observation:

A white/grey solid dissolves and a bright yellow solid is formed. (1 mark)

c. Lead(II) nitrate solution is added to sodium sulfide solution (3 marks)

Equation:

$Pb^{2+}(aq) + S^{2-}(aq) \rightarrow PbS(s)$ (2 marks)

Observation:

A grey solid is formed from a colourless solution. (1 mark)

d. Cobalt(II) ethanoate is added to a solution of sodium phosphate. (3 marks)

Equation:

$3\ Co^{2+}(aq) + 2\ PO_4^{3-}(aq) \rightarrow Co_3(PO_4)_2(s)$ (2 marks)

Observation:

A pink solid is formed from a pink solution. (1 mark)

End of Section 2

Section 3 – Extended Response (18 marks)

Question 14 (8 marks)

The following observations were taken from a school practical by two year 11 students, by mixing together solutions A-D. The solutions contain the ionic compounds sodium carbonate, barium iodide, potassium hydroxide and lead(II) nitrate.

	A	B	C	D
A		Yellow ppt	White ppt	White ppt
B	Yellow ppt		White ppt	NVR
C	White ppt	White ppt		NVR
D	White ppt	NVR	NVR	

a. Write a step-wise procedure to determine each of the unknown solutions. Clearly identify the four unknowns.

A = $Pb(NO_3)_2$ **B = BaI_2**

C = Na_2CO_3 **D = KOH**

Step one: lead(II) nitrate is the only solution which will form a ppt with all other solutions. Therefore, A = $Pb(NO_3)_2$

Step two: Lead(II) nitrate forms a yellow ppt with barium iodide. Therefore, B = BaI_2

Step three: Sodium carbonate forms a ppt with two other solutions (lead(II) nitrate and barium iodide) while KOH form only a ppt with lead(II) nitrate. Therefore, C = Na_2CO_3 and D = KOH.

(2 marks for the correct identity of each and explanation).

Question 15 **(10 marks)**

In a chemical laboratory, the labels have fallen off four identical reagent bottles. Each bottle contains a colourless solution. The labels read:

Silver nitrate	Potassium sulfide	Sodium hydroxide	Ammonium sulfate

Only three tests are required to distinguish between the four solutions.

Describe briefly the three chemical tests that can be used to identify which label belongs with each of the four reagent bottles. For each test describe clearly the expected observations and how they are used to identify the unknown solution.

Note: You may use any reagent in your tests but not acid-base indicators or a pH meter. No equations are required.

Test	Describe the test	Expected observations	Unknown substance formula
1	Add NaCl to each unknown.	One solution will form a white ppt.	$AgNO_3$
2	Add $Ba(NO_3)_2$ to each unknown.	Two of the three solutions will form a ppt. The NVR is NaOH.	NaOH
3	Add $Cu(NO_3)_2$ to the two solutions.	A ppt will form with the K2S and not the $(NH_4)_2SO_4$.	K_2S
4	The remaining unknown must be: $(NH_4)_2SO_4$		

(1 mark for each box)

End of Section 3